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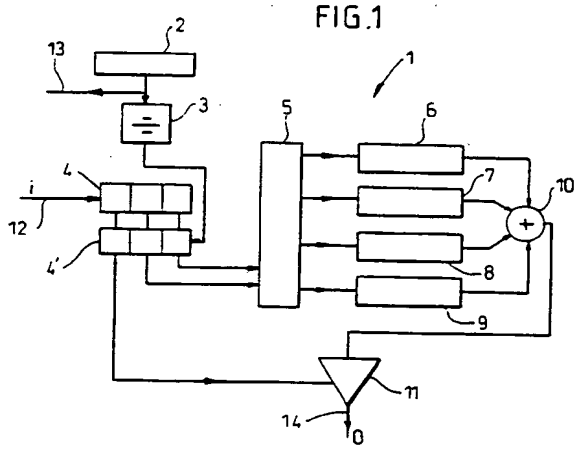
(54) Modem semi-duplex pour réseau de radiotéléphones GSM.

(57) Le modem peut recevoir des données numériques 12 et les transformer en données analogiques 14 du type de celle de la parole et susceptibles d'être traitées par un codec GSM. La partie modulateur 1 comporte un circuit de portes logiques 5, une batterie de générateurs de fréquence 6-9, un multiplexeur 10 et un amplificateur à gain variable 11.

Le modem permet de s'affranchir des unités IWF du réseau GSM.

FIG.1



EP 0 545 783 A1

Le réseau GSM (Groupe Special Mobile) permet l'interconnexion de radiotétéphones mobiles entre eux ainsi qu'entre un radiotéléphone et un téléphone normal par l'intermédiaire du réseau RTC (réseau téléphonique commuté).

Avec un radiotéléphone GSM, le combiné délivre des données vocales analogiques qui sont transformées par un codeur-décodeur (Codec) en un flot numérique à 14 kbits/s pour transmission sur la voie radio. Ce rythme, dans la partie terrestre du réseau GSM, est transformé en 64 kbits/s, pour l'intercommunication avec le réseau RTC. Le réseau RTC, dans l'essentiel de son infrastructure, transporte le signal téléphonique de 300 à 3 400 Hz sous forme numérique par échantillonnage à la fréquence de 8 kHz, à raison de 8 bits par échantillon, ce qui représente bien un flot de données au rythme de 64 kbits/s.

Le codec GSM a été conçu pour transmettre la voix et convient mal à la transmission de données de modems (modulateurs - démodulateurs).

Or le réseau RTC sert couramment à transmettre, outre la voix, des signaux de modem de transmission de données occupant la même bande 300-3400 HZ. Pour offrir le même service sur le réseau GSM, il a été prévu que les transmissions de données sur GSM se feraient directement en numérique, ce qui conduit d'ailleurs à une meilleure occupation du spectre et à une plus grande robustesse de transmission.

Un mobile GSM de transmission de données transmet donc en numérique, à certains débits déterminés par les normes GSM, par exemple 9600 ou 4800 bits/s. A l'interconnexion avec le réseau RTC, au moyen d'unités d'interfonctionnement IWF (interworking functions), comprenant des batteries de modems aux normes du CCITT, les données numériques sont transformées en signaux analogiques.

Une telle transmission numérique est satisfaisante pour l'interconnexion de deux radiotéléphones mobiles entre-eux, mais elle présente des inconvénients.

D'abord, pour communiquer avec des terminaux de transmission de données sur le réseau RTC, il faut attendre la disponibilité des fonctions d'interfonctionnement dans le réseau GSM. Ensuite, la transmission est limitée à l'emploi de modems normalisés qui, en outre, n'assurent pas une parfaite confidentialité de transmission. Or deux correspondants peuvent parfaitement vouloir maîtriser de bout en bout le système de modulation et utiliser des protocoles particuliers adaptés au taux d'erreur global ainsi qu'à l'application. Il en est ainsi de la transmission de petits messages au sein d'une flotte de véhicules et, plus généralement, de la transmission de quantités d'information ou de débits faibles.

La présente invention vise à contourner ces inconvénients, c'est-à-dire, et éventuellement, à s'affranchir des unités d'interfonctionnement IWF du réseau GSM.

A cet effet, la présente invention concerne un modem semi-duplex, caractérisé par le fait qu'il est agencé pour recevoir des données numériques et les transformer en données analogiques du type de celle de la parole et susceptibles d'être traitées par un codec GSM ou inversement.

Les données transmises par le modem de l'invention ressemblent à des données de parole, sans en être, ce qui permet aux correspondants de faire intrusion sur les circuits de parole du réseau GSM et donc d'éviter les inconvénients des unités IWF.

Ainsi, et par exemple, le modem de l'invention pourra être substitué au microphone et au haut-parleur d'un radiotéléphone GSM et servir d'interface entre un tel radiotéléphone et un terminal télématique à écran et clavier tout autant du commerce. Les données numériques du terminal d'un abonné sont transformées, dans le modem, en pseudo données analogiques de parole, traversent le codec du radiotéléphone et en sortent au rythme de 14 kbits/s qui est transposé, dans le réseau GSM, à 64 kbits/s sans passer par les unités IWF, avant de traverser le réseau RTC et d'arriver sur le terminal télématique d'un autre abonné, avec une communication transparente de bout en bout entre les deux abonnés.

On soulignera que l'invention, finalement, va à l'encontre de l'évolution technique à laquelle on a assisté jusqu'à maintenant.

Dans la forme de réalisation préférée du modem de l'invention, il est prévu des moyens de modulation en amplitude et ou en fréquence à un faible rythme, avantageusement de 300 bauds. Le signal résultant est ainsi doté de caractéristiques proches de celles de la voie humaine au regard du codec GSM. A l'inverse, un rythme élevé et la modulation de phase, généralement adoptés dans les modems performants, traversent mal le codec GSM.

De préférence encore, le modem de l'invention comporte des moyens de génération de signaux d'une fréquence choisie parmi plusieurs, avantageusement quatre, et d'une amplitude choisie aussi parmi plusieurs, avantageusement deux, le modem transposant ainsi des données numériques d'entrée en signaux de sortie choisis parmi huit (2^3), soit sur trois bits et huit états par baud, avec un débit total, dans le cas d'un rythme de modulation de 300 bauds, de 900 bits/s.

L'invention sera mieux comprise à l'aide de la description suivante de deux formes de réalisation du modem de l'invention, en référence au dessin annexé sur lequel

- la figure 1 est une représentation schématique par blocs du modulateur de la première forme de réalisation du modem de l'invention ;
- la figure 2 est une représentation schématique du démodulateur de la première forme de réalisation du modem de l'invention ;
- la figure 3 est une représentation schématique du modulateur de la deuxième forme de réali-

sation du modem de l'invention et

- la figure 4 est une représentation schématique du démodulateur de la deuxième forme de réalisation du modem de l'invention.

Le modulateur 1 du modem semi-duplex de la figure 1 comporte une horloge 2, un registre à décalage 4, un circuit de portes logiques 5, une batterie de quatre générateurs de fréquence 6 - 9, un multiplexeur 10 et un amplificateur à gain variable 11.

Dans l'exemple considéré, le modulateur peut fournir huit états correspondant à quatre fréquences et deux amplitudes. Les deux amplitudes correspondent à deux gains différents A_1, A_2 de l'amplificateur 11, ici 1 et 2. Les quatre fréquences des quatre générateurs 6 - 9 sont ici, mais elles pourraient être différentes, f1 = 900 Hz, f2 = 1 100 Hz, f3 = 1 300 Hz, f4 = 1 500 Hz, générant un spectre parfaitement compatible avec la bande passante du réseau téléphonique commuté ordinaire RTC, qui s'étend de 300 à 3 400 Hz, et avec la réponse en fréquence pure du codec GSM (connue pour dépasser 2000 Hz), permettant, au travers des réseaux GSM et RTC, de mettre en relation deux terminaux télématiques d'un abonné appelant et d'un abonné appelé connectés à l'un ou l'autre des deux réseaux.

L'horloge 2 fournit ici 900 bits par seconde. Les bits du signal numérique d'entrée 12 sont groupés par paquets de trois, ou tribits, au moyen d'un registre 4 recevant les bits en série à 900 bits/s et les recopiant en parallèle dans un registre 4' à un rythme de 300 Hz fourni par le diviseur 3. Les deux derniers bits procèdent à la sélection de fréquence, effectuée dans le circuit de portes 5, relié au registre 4', selon la table suivante

00	f1
01	f2
10	f3
11	f4

pour commander la mise en marche des générateurs 6 - 9.

Le premier bit procède à la sélection d'amplitude et commande le gain de l'amplificateur 11.

Ainsi, la première case du registre 4 est reliée à la commande de gain de l'amplificateur 11, les deux dernières cases, au circuit de portes 5.

On notera que le regroupement des bits d'entrée en tribits s'effectue sans référence de phase et c'est sans importance. De même, il est indifférent qu'un bit 0 ou 1 commande un gain 1 ou 2 de l'amplificateur 11. Le signal d'horloge 13 de l'horloge 2 est en effet récupéré par le démodulateur du modem de l'abonné appelé et la démodulation procède exactement aux étapes inverses de celles de la modulation.

Le signal fourni par l'un des générateurs 6 - 9, qui traverse le multiplexeur 10, est amplifié, selon l'un ou l'autre de ses deux gains, par l'amplificateur 11 qui fournit le signal de sortie 14.

Le démodulateur 15 de la première forme de réalisation du modem semi-duplex de la figure 2 comporte un circuit 16 de contrôle automatique de gain qui est relié à un détecteur d'amplitude 17 et un écreteur 18 et qui reçoit le signal d'entrée 21. Le détecteur 17, relié à un extracteur d'horloge 20, fournit le premier bit d'amplitude qui est stocké dans la première case d'un registre à décalage 19. L'écreteur 18 est relié à l'entrée d'un démodulateur de fréquence 22 dont la sortie est reliée à un circuit de seuil 23 qui fournit sur deux fils, reliés à l'extracteur 20, les deux bits de fréquence qui sont stockés respectivement dans les deux dernières cases du registre 19. L'extracteur 20, connu en soi, procède à l'extraction du signal d'horloge 24, à 900 Hz, ici par boucle a verrouillage de phase. Un signal d'horloge 24', à 300 Hz, provoque la copie parallèle du registre 19 dans un registre 19' qui est vidé en série au rythme de l'horloge 24 à 900 Hz pour constituer le signal numérique de sortie 25.

Le modulateur 26 de la deuxième forme de réalisation du modem semi-duplex de la figure 3 comporte une horloge 30, un diviseur d'horloge 31, un registre à décalage 32, un modem du commerce V 21 à modulation de fréquence et à retard déterminé, référencé 33 sur le dessin, un amplificateur à gain variable 34, une ligne à retard 35, entre le registre 32 et l'amplificateur 34, pour engendrer un retard égal à celui du modem 33.

Dans ce deuxième exemple, le modulateur 26 est structuré autour d'un modulateur du commerce et ne fournit que quatre états possibles correspondant à deux fréquences et deux amplitudes possibles. Le modem 33, qui peut être par exemple le modem EF7910 de la société Thomson, peut fournir un signal modulé à 980 Hz et 1 180 Hz. L'horloge 30 fournit ici 600 bits par seconde. Les bits du signal numérique d'entrée 27 sont groupés par paires au moyen du registre 32 les recevant en série à 600 bits/s et les recopiant en parallèle dans un registre 32' à un rythme de 300 Hz fourni par le diviseur 31, qui divise par 2. Le dernier bit procède à la sélection de fréquence dans le modem 33 et le premier bit à la sélection d'amplitude et commande le gain de l'amplificateur 34 qui founit le pseudosignal analogique de parole 28.

Le fontionnement du modulateur 26 est identique à celui du modulateur 1 et ne s'en distingue que par le remplacement, par le modem du commerce 33, du circuit de portes 5, de la batterie de générateurs 6 - 9 et du multiplexeur 10.

Le démodulateur 36 de la deuxième forme de réalisation du modem semi-duplex de la figure 4 est très semblable au démodulateur 15 de la figure 2, avec un circuit 37 de contrôle automatique de gain, un détecteur d'amplitude 38, un écreteur 39, un extrac-

teur d'horloge 42 et deux registres 41 et 41', ici, à deux cases. Le démodulateur 36, dont le fonctionnement est identique à celui du démodulateur 15, s'en distingue au plan structurel par le remplacement, par un modem V21, le même que celui du modulateur 26, référencé 40 sur le dessin, du démodulateur de fréquence 22 et du circuit de seuil 23, d'une part, et le branchement d'une ligne à retard 43 entre le détecteur 38 et l'extracteur 42.

On vient de décrire deux modems transposant des données numériques d'entrée en signaux de sortie choisis parmi plusieurs états possibles correspondant à diverses fréquences de modulation (4 ou 2) et amplitudes de modulation (2). On peut bien entendu pondérer différemment ces paramètres fréquence et amplitude et, par exemple, supprimer totalement la modulation d'amplitude.

Revendications

1. Modem semi-duplex, caractérisé par le fait qu'il est agencé pour recevoir des données numériques (12;27) et les transformer en données analogiques (14;28) du type de celle de la parole et susceptibles d'être traitées par un codec GSM ou inversement.

2. Modem selon la revendication 1, dans lequel il est prévu des moyens de modulation en amplitude (4,4',11;32,32',34).

3. Modem selon la revendication 2, dans lequel il est prévu un modulateur (1;26) de génération de signaux d'une amplitude choisie parmi plusieurs.

4. Modem selon la revendication 3, dans lequel le modulateur (1;26) comporte un amplificateur à deux gains (11;34).

5. Modem selon l'une des revendications 1 à 4, dans lequel il est prévu des moyens de modulation en fréquence (4-10;32,32',33).

6. Modem selon la revendication 5, dans lequel il est prévu un modulateur (1;26) de génération de signaux d'une fréquence choisie parmi plusieurs.

7. Modem selon la revendication 6, dans lequel le modulateur (1) comporte un circuit de portes logiques (5), une batterie de générateurs de fréquence (6-9) et un multiplexeur (10).

8. Modem selon la revendication 6, dans lequel le modulateur (26) comporte un modem à modulation de fréquence du commerce (33).

9. Modem selon l'une des revendications 1 à 8, dans lequel les données numériques (12;27) sont reçues dans un registre à décalage (4;32).

10. Modem selon la revendication 7, dans lequel il est prévu un démodulateur (15) comportant un démodulateur de fréquence (22) et un circuit de seuil (23).

11. Modem selon la revendication 8, dans lequel il est prévu un démodulateur (36) comportant un modem à modulation de fréquence du commerce (40).

12. Modem selon l'une des revendications 10 et 11, dans lequel le modulateur (1;26) comporte une horloge (2;30) et le démodulateur (15;36) comporte deux registres à décalage (19,19';41;41') commandés par un extracteur d'horloge (20;42) à extraction par boucle à verrouillage de phase.

FIG.1

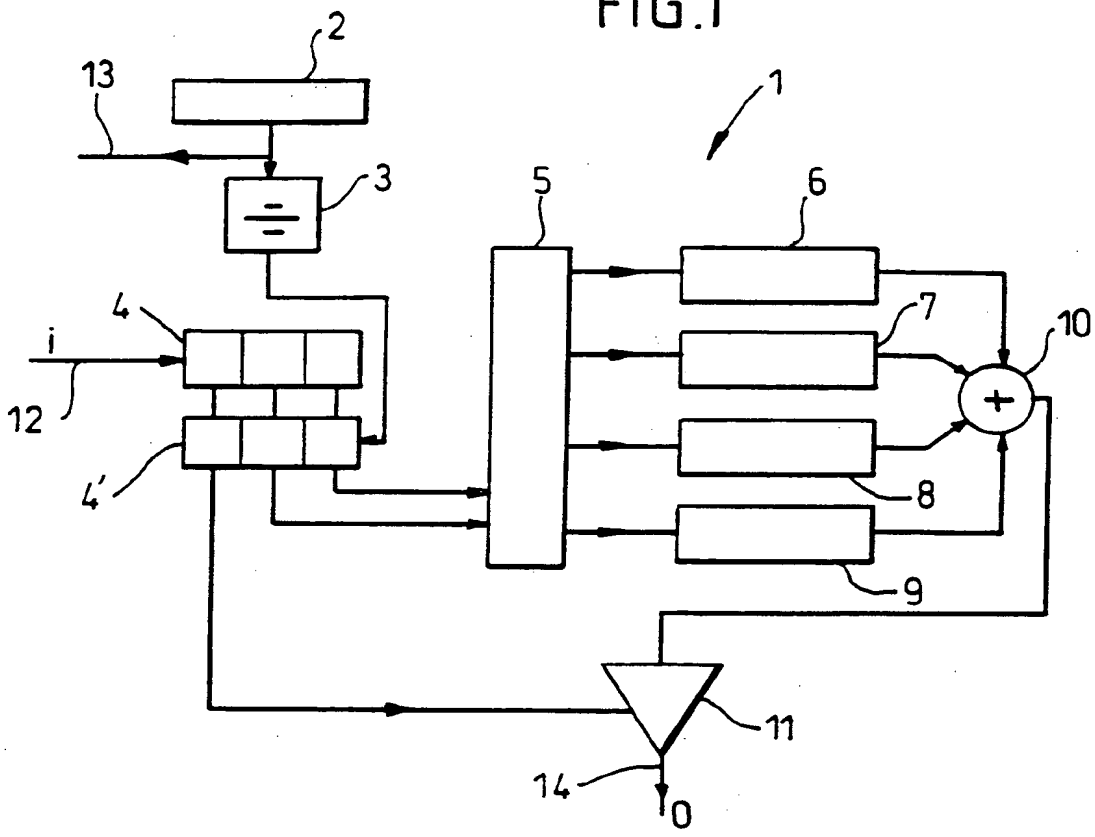


FIG.2

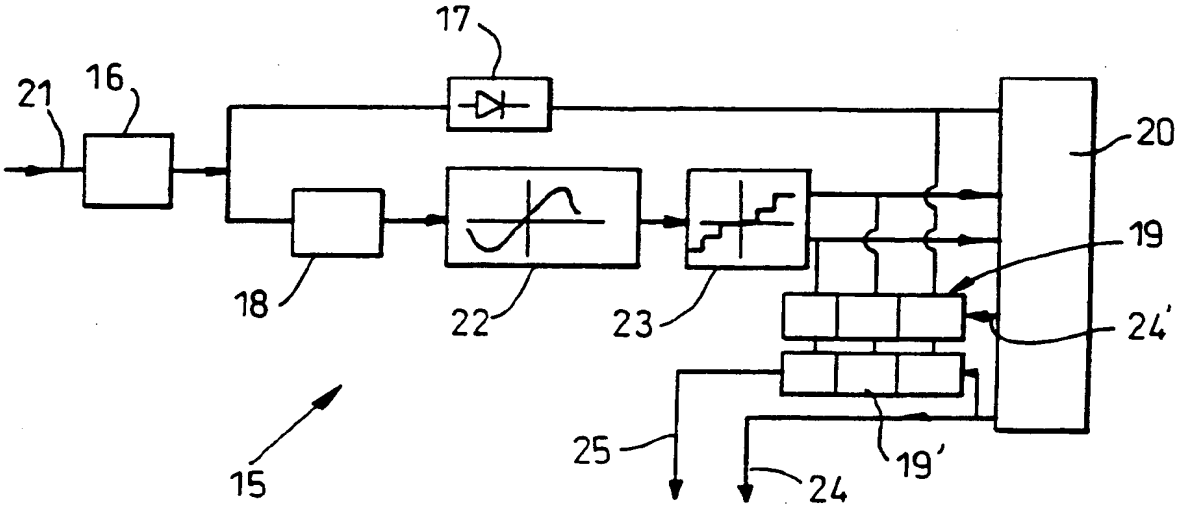


FIG.3

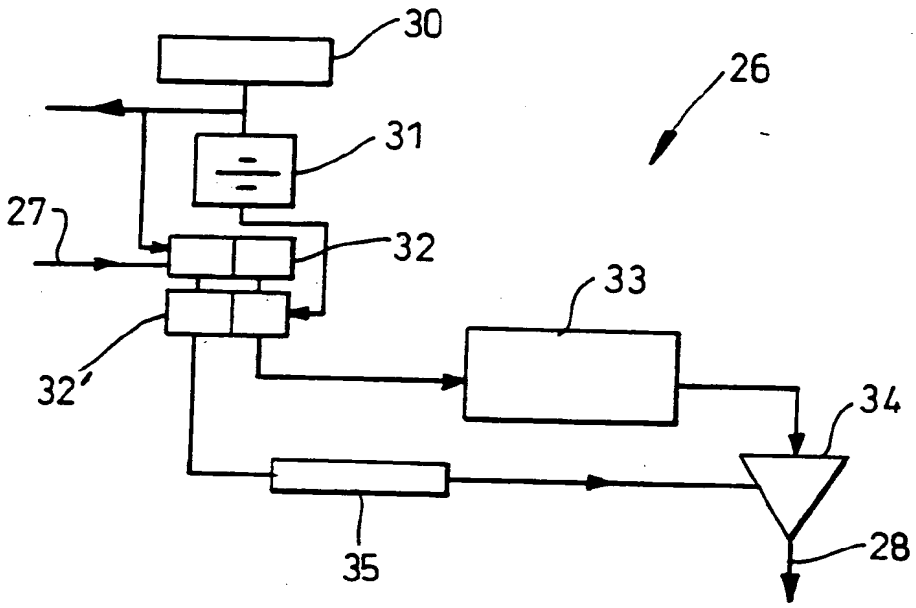
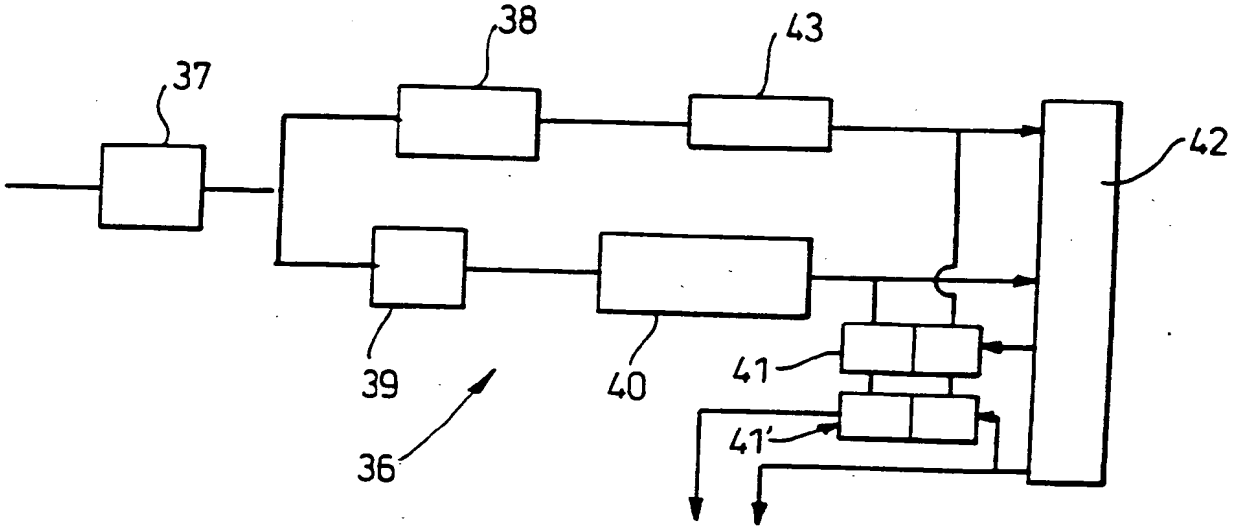


FIG.4



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RAPPORT DE RECHERCHE EUROPEENNE

Numero de la demande

EP 92 40 3185

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Lieu de la recherche	Date d'achèvement de la recherche	Examinateur
LA HAYE	29-01-1993	GRIES T M

CATEGORIE DES DOCUMENTS CITES

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Numero de la demande

EP 92 40 3185

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Le présent rapport a été établi pour toutes les revendications

Lieu de la recherche	Date d'achèvement de la recherche	Examinateur
LA HAYE	29-01-1993	GRIES T M

EPO FORM 1503 03.82 (P0402)

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D : cité dans la demande
L : cité pour d'autres raisons

& : membre de la même famille, document correspondant

US005786789A

United States Patent [19]

Janky

[11] Patent Number: 5,786,789

[45] Date of Patent: Jul. 28, 1998

[54] **GPS AND CELLPHONE UNIT HAVING ADD-ON MODULES**

[75] Inventor: **James M. Janky**, Los Altos, Calif.

[73] Assignee: **Trimble Navigation Limited**, Sunnyvale, Calif.

[21] Appl. No.: **339,990**

[22] Filed: **Nov. 14, 1994**

[51] **Int. Cl.**[6] **G01S 5/02**

[52] **U.S. Cl.** **342/357**; 342/419; 455/33.1; 455/89

[58] **Field of Search** 342/357, 419; 455/33.1, 90, 89

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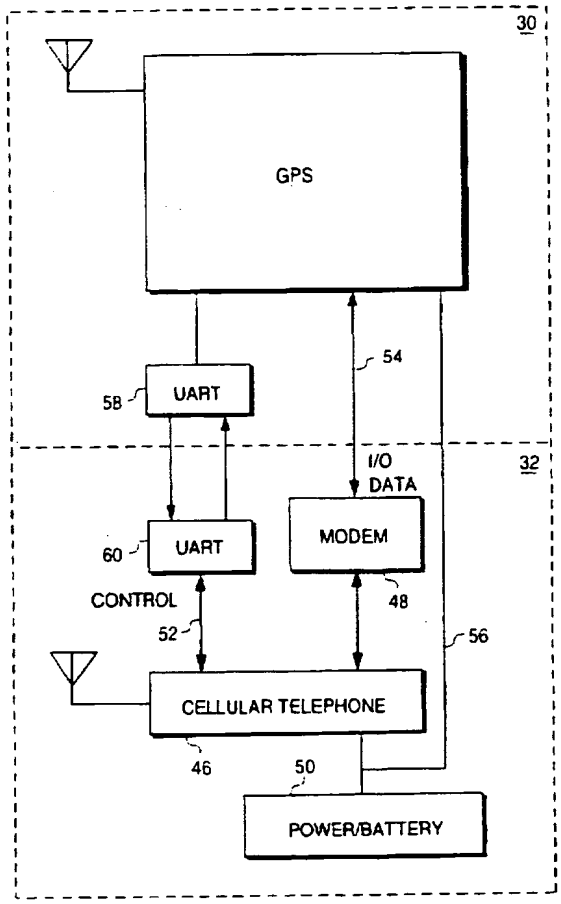
Primary Examiner—Thomas H. Tarcza
Assistant Examiner—Dao L. Phan
Attorney, Agent, or Firm—Patrick T. King

[57] **ABSTRACT**

A GPS unit and a cellular telephone unit each have add-on modules for providing additional functionality. A battery powered hand-held GPS unit has a battery power module with a built-in cellular telephone. The controls on the GPS unit are used to control cellular telephone operations. The GPS controlled cellular telephone transmits position location information obtained by the GPS unit. Alternatively, a battery powered hand-held cellular telephone unit has a battery power module with a built-in GPS device. The controls on the cellular telephone portion are used to control GPS device operations. The cellular telephone portion is able to transmit position location information obtained by the GPS device. The GPS and a cellular telephone device can function with either a standard battery module, or with a battery module having a cellular telephone or a GPS device built into the battery module.

14 Claims, 9 Drawing Sheets



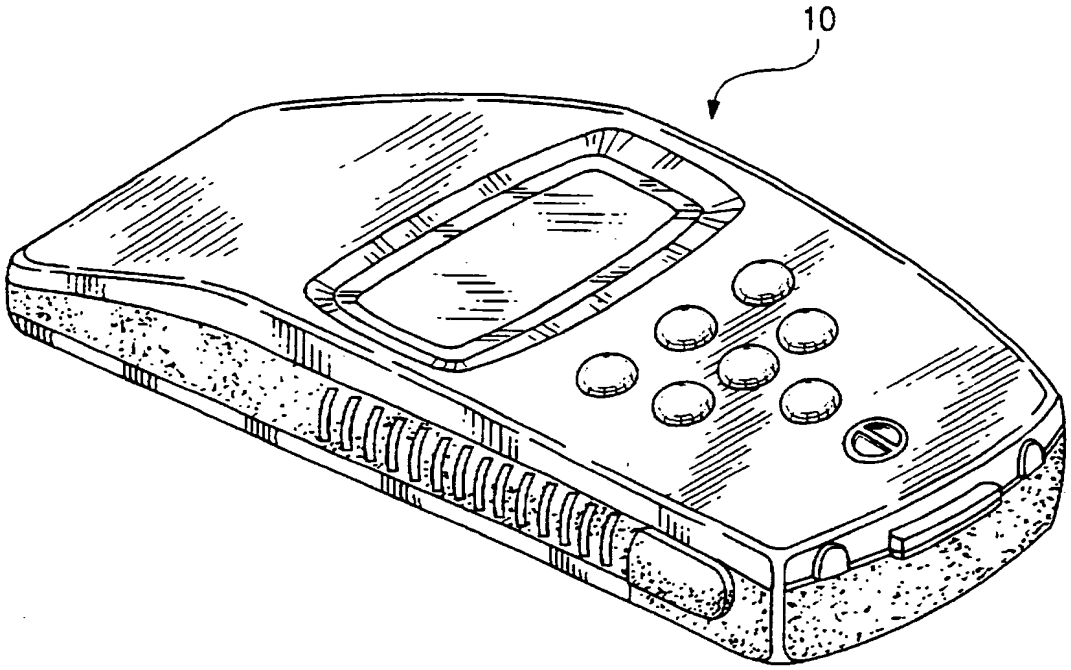


Figure 1A (Prior Art)

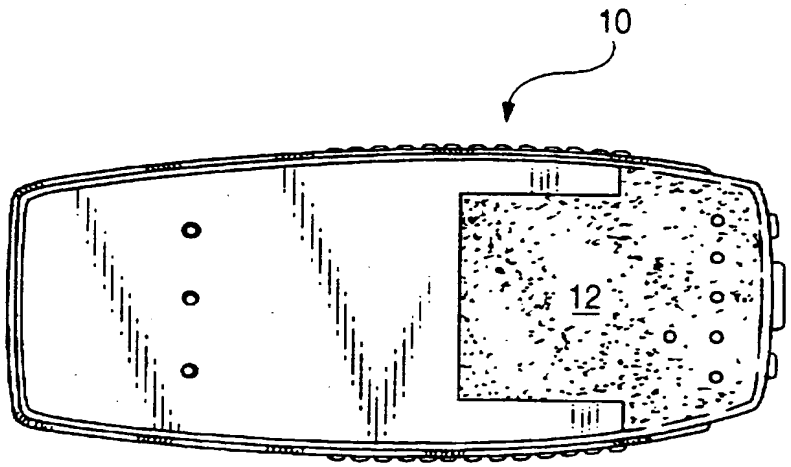


Figure 1B (Prior Art)

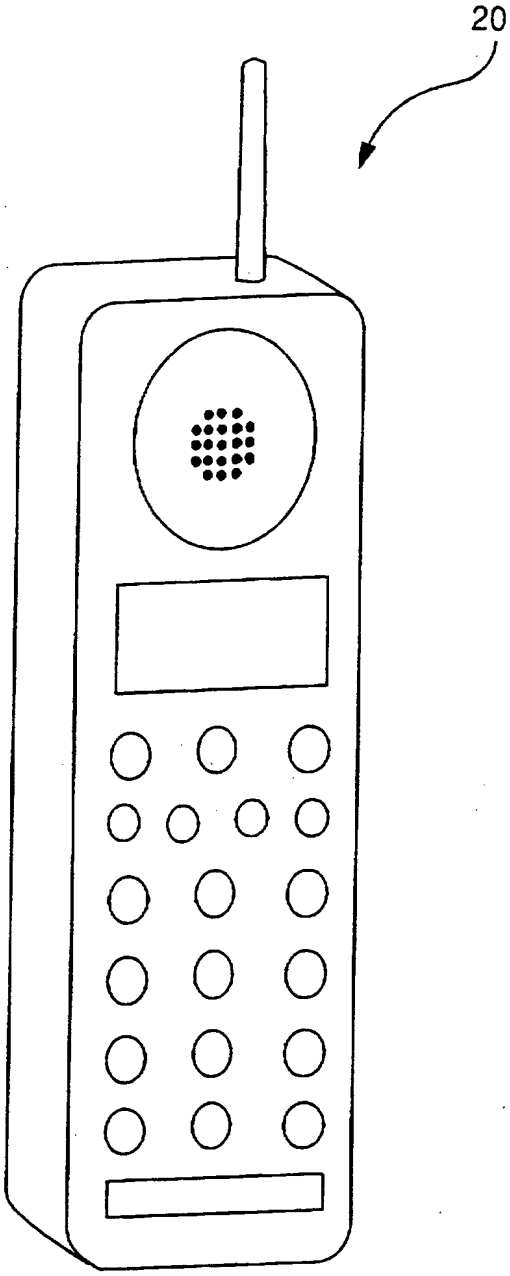


Figure 2 (Prior Art)

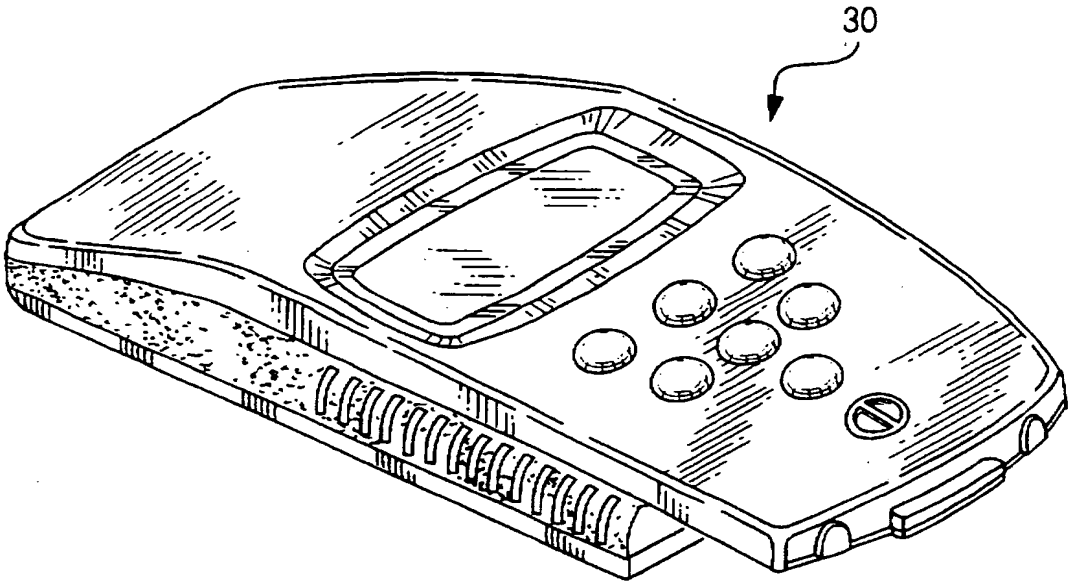


Figure 3A

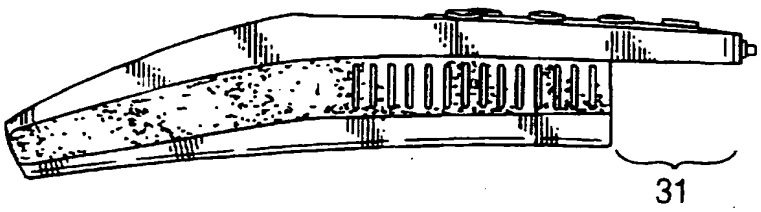


Figure 3B

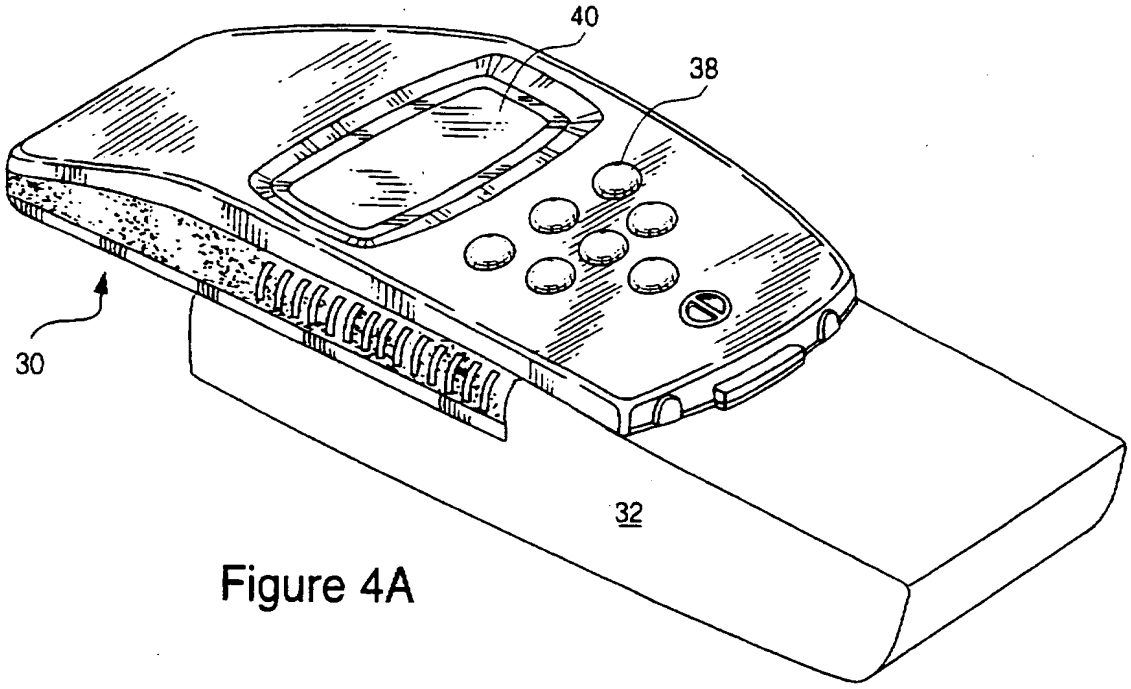


Figure 4A

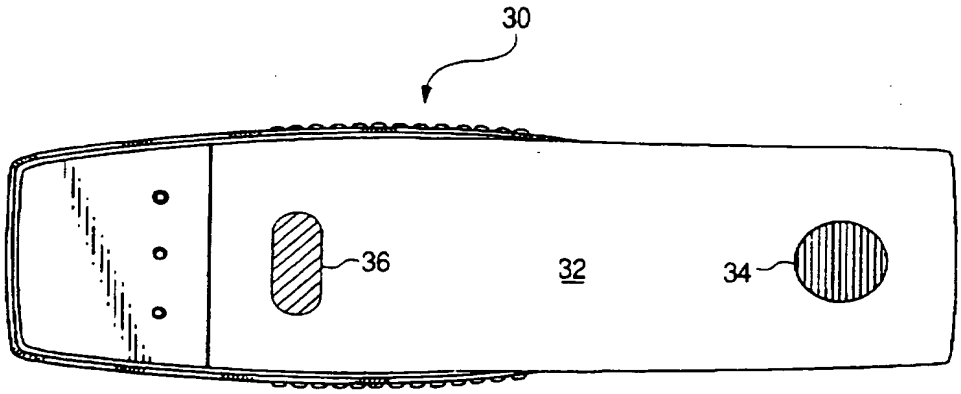


Figure 4B

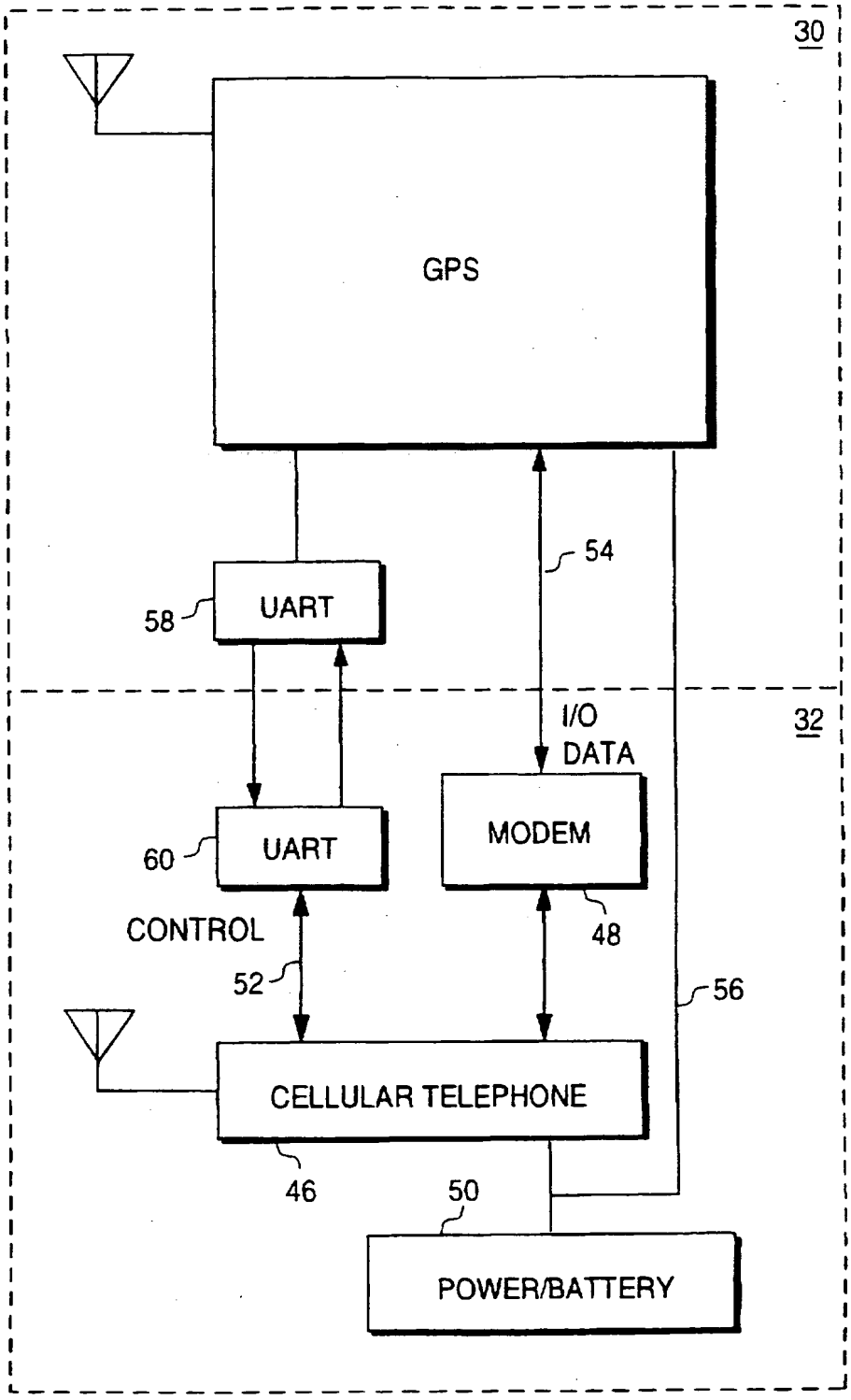


Figure 5

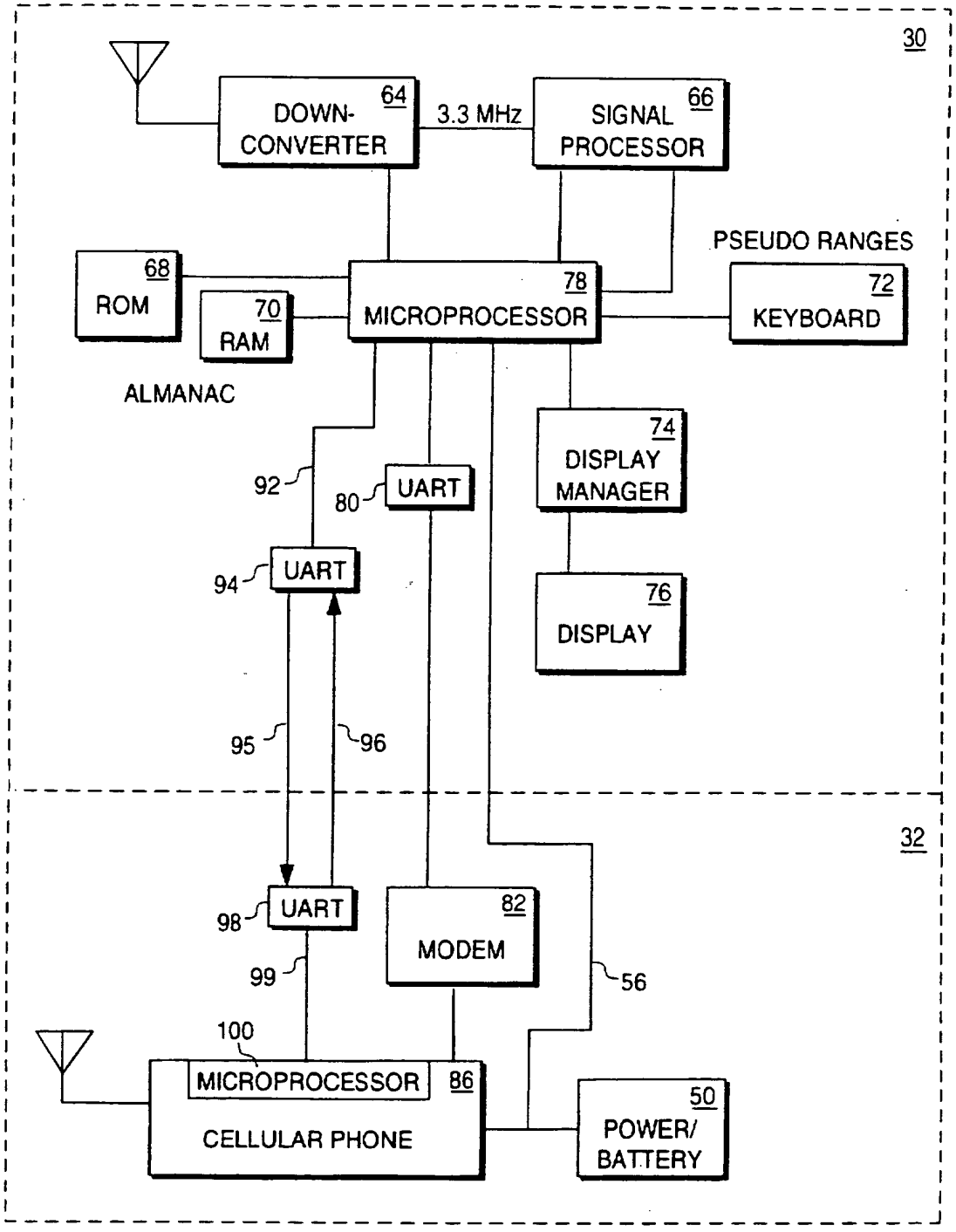


Figure 6

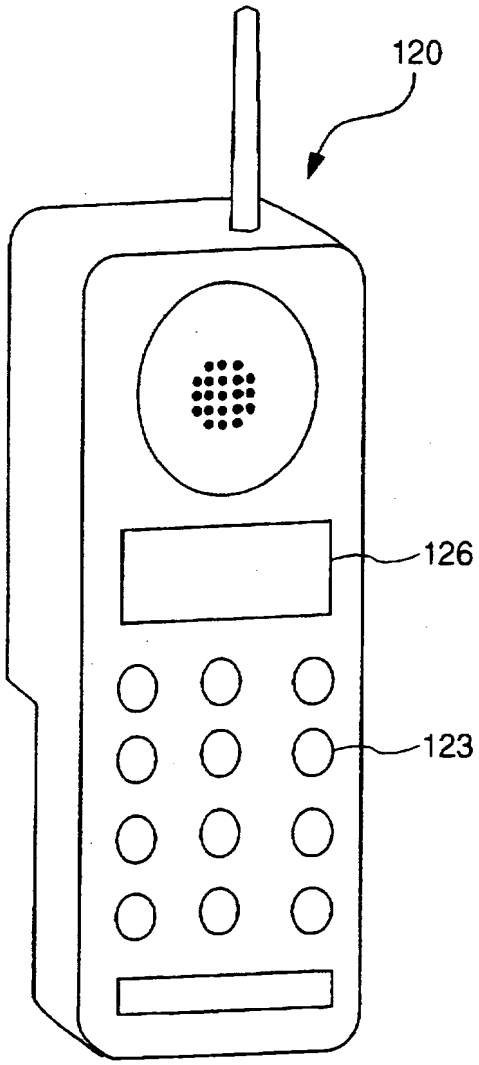


Figure 7A

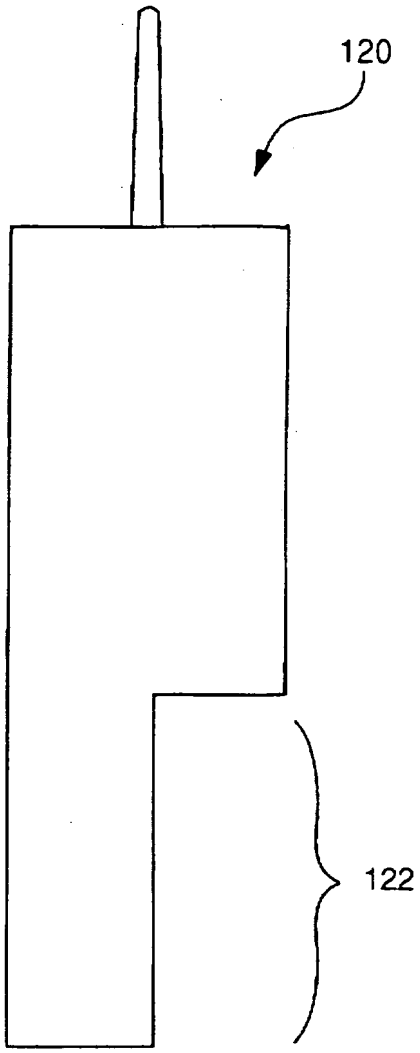


Figure 7B

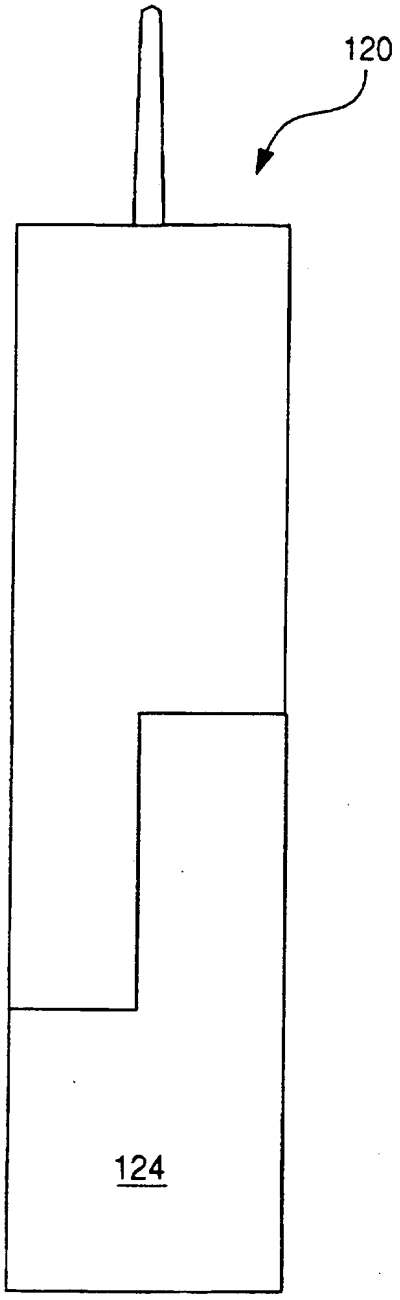


Figure 8

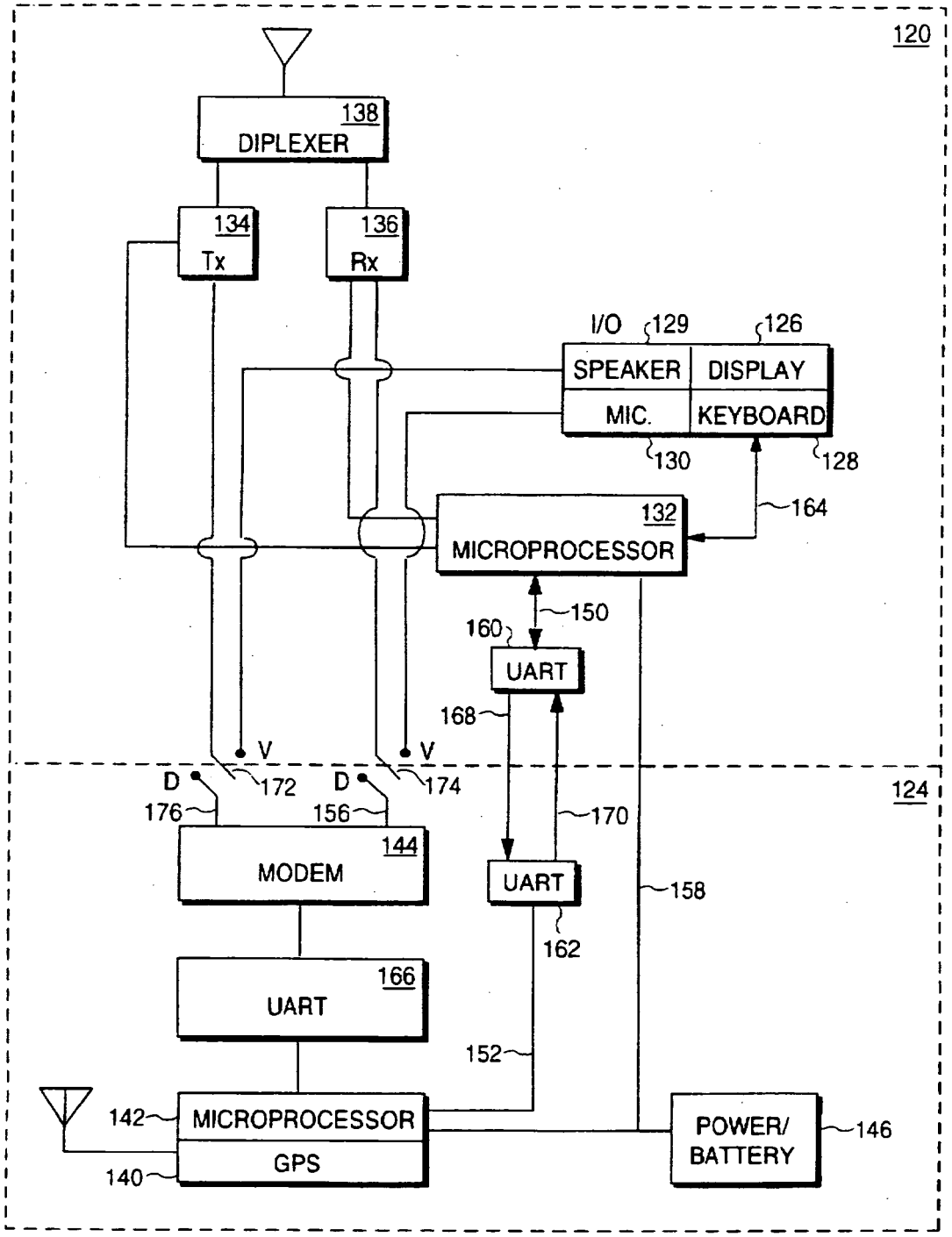


Figure 9

GPS AND CELLPHONE UNIT HAVING ADD-ON MODULES

TECHNICAL FIELD

This invention relates to GPS and cellular telephone devices. Specifically, the present invention relates to hand-held GPS and cellular telephone units.

BACKGROUND ART

Hand-held GPS devices, such as the Scout by Trimble Navigation, Ltd. and hand-held cellular telephone devices, such as the Micro Tac flip-phones by Motorola, Inc. are both well known in the prior art. Such devices are battery powered by a battery pack which is attached either to the hand-held GPS device or to the cellular telephone device. When the batteries are discharged, a charged battery pack is attached to the hand-held GPS device or to the cellular telephone device. Hand-held GPS devices and hand-held cellular telephone devices operate in different frequency regimes and function independently of each other. Typical hand-held GPS devices do not have cellular telephone capability, and, typical cellular telephone devices do not have GPS capability.

Prior Art FIG. 1A shows a perspective view of a small, battery powered, hand-held GPS receiver 10. With reference next to Prior Art FIG. 1B, a bottom view of GPS receiver 10 is shown. Receiver 10 includes a battery portion 12. Battery portion 12 can be a cover plate disposed over batteries such as, for example, 4 AA batteries, or may be the outline of, for example, a rechargeable power supply. In the Prior Art, receiver 10 functions only as a GPS receiver. That is, receiver 10 has no cellular telephone capabilities. Thus, if a user wishes to relay his or her position information to a remote station, the user must first locate suitable communication facilities.

Prior art FIG. 2 shows a combined GPS and cellular telephone device 20. The combined GPS and cellular telephone device 20 is, for example, a "remote unit" as set forth U.S. Pat. No. 5,043,736 to Darnell et al. The Darnell remote unit includes an RF L-band receiver for a global positioning system and a cellular phone system. The GPS and cellular telephone systems of the Darnell reference are permanently combined and integrated into a single unit.

While combination GPS and cellular telephone devices are known, the additional expense, bulk, and complexity associated with such combination devices may not appeal to a consumer at the time of purchase. The consumer may desire only the functionality of a GPS device or the functionality of a cellular phone and later may want to add additional functionality.

The need has arisen for a GPS and cellular phone combination which does not inherently add substantial expense, or bulk or to an originally purchased device. Additionally, the combined GPS and cellular phone device should not appear to be substantially more complex in operation than a single GPS or cellular telephone unit to avoid intimidating a potential consumer.

DISCLOSURE OF THE INVENTION

It is therefore an object of the present invention to provide a GPS and cellular phone combination which does not inherently add substantial expense, or bulk or to the device, and which does not intimidate a potential consumer by appearing to be substantially more complex than a single GPS or cellular telephone unit at the time of purchase. The

above object has been achieved by a GPS device and a cellular telephone device having add-on modules.

In accordance with this and other objects of the invention, a hand-held communication device is provided which includes two functions: a position-locating function and a cellular telephone function. The communication device includes a core module and a removable add-on module. Two functions are provided according to the invention. The core module provides one function and the add-on module provides the other function. The core module has means, such as a keypad and display screen, for entering and displaying information. The core module provides a first function. The core module also includes a removable add-on module. The removable add-on module is removably coupled to the core module and includes a power unit for providing power to the first function in the core module. The removable add-on module also has a second means integral therewith for providing a second function. The first function and the second function include a GPS function and a cell phone function. Power as well as control and information signals are removably coupled between the core module and the removable add-on module. In addition, the core module includes means for controlling the second function provided by the removable add-on module.

In one embodiment of the invention, a battery powered hand-held GPS unit has a main GPS unit which is structured such that a battery power module can be attached to and removed from the hand-held GPS portion. In this embodiment, a battery pack power module, which is attachable to or removable from the hand-held GPS portion, includes a built-in cellular telephone unit. The display and button controls on the main GPS unit are then used to control standard cellular telephone operations. The GPS controlled cellular telephone unit transmits position location information obtained by the GPS unit. In so doing, the consumer can purchase a GPS device which has a standard appearance but which is capable of being upgraded to a combination GPS and cellular telephone unit, which is operated by the display and controls of the GPS unit.

In another embodiment of the invention, a battery-powered hand-held cellular telephone unit has a main cellular telephone unit which is structured such that a battery power module, or battery pack, can be attached to and removed from the cellular telephone portion. In this embodiment, a battery power module which is attachable to or removable from the cellular telephone portion includes a built-in GPS unit. The controls on the cellular telephone portion are then used to control the GPS unit operations. The cellular telephone portion is able to transmit position location information obtained by the GPS device. Thus, a combined GPS and cellular telephone unit is disclosed which can function as a telephone with a standard battery module, or with a battery module having a GPS device built into the battery module.

Therefore, the present invention provides a GPS and cellular phone combination which does not inherently add substantial expense, or bulk or to the device, and which does not intimidate a potential consumer by appearing to be substantially more complex than a single GPS or cellular telephone unit at the time of purchase.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and form a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention:

FIG. 1A is a perspective view of a Prior Art small, battery powered, hand-held GPS receiver.

FIG. 1B is a bottom view of the Prior Art receiver of FIG. 1A.

FIG. 2 is a front elevation view of a Prior Art combined single-unit GPS and cellular telephone device.

FIG. 3A is a perspective view of one embodiment of a GPS unit wherein the battery portion of GPS device 30 has been removed.

FIG. 3B is a side view of the GPS unit of FIG. 3A.

FIG. 4A is a perspective view of an add-on module including an integral cellular telephone removably attached to a GPS device in accordance with the present invention.

FIG. 4B is a bottom view of add-on module including an integral cellular telephone removably attached to a GPS device as shown in FIG. 4A in accordance with the present invention.

FIG. 5 is a schematic circuit diagram illustrating the interconnections between a GPS device and an add-on module in accordance with the present invention.

FIG. 6 is a schematic circuit diagram illustrating features of a GPS device and the interconnections between a GPS device and an add-on module in accordance with the present invention.

FIG. 7A is a front view of one embodiment of a cellular telephone device wherein the battery portion of a cellular telephone device has been removed in accordance with the present invention.

FIG. 7B is a side view of the cellular telephone device of FIG. 7A in accordance with the present invention.

FIG. 8 is a perspective view of an add-on module including an integral GPS removably attached to a cellular telephone device in accordance with the present invention.

FIG. 9 is a schematic circuit diagram illustrating features of a cellular telephone device and the interconnection of the cellular telephone device and a GPS add-on module.

BEST MODE FOR CARRYING OUT THE INVENTION

Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the preferred embodiments, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims.

FIG. 3A shows a perspective view of one embodiment of a GPS device 30 wherein the battery portion of the GPS device 30 has been removed. GPS receiver 30 is, for example, the Scout GPS, available from Trimble Navigation Limited of Sunnyvale, Calif.

FIG. 3B shows a side view of the device 30. A cavity 31 exists where batteries or a battery pack would normally reside. Although GPS device 30 of FIGS. 3A and 3B is, for example, the Scout GPS, the present invention is also well suited to use with numerous other GPS devices well known in the art.

With reference next to FIG. 4A, a perspective view is shown of a GPS device 30 with an attached add-on module 32 in accordance with the present invention. As shown in FIG. 4A, in the present embodiment of the invention, the add-on module 32 is inserted into the cavity 31 of the GPS device 30. In addition to supplying power to GPS device 30 via, for example, a battery pack, the add-on module 32 also includes a built in cellular telephone. In the present invention, the GPS device 30 is adapted to receive either a standard battery supply or a combined power source and cellular telephone as embodied in add-on module 32.

With reference next to FIG. 4B, a bottom view of an add-on module 32 attached to GPS device 30 is shown. As shown in FIG. 4B, add-on module 32 includes a microphone 34 and earphone 36. Thus, add-on module 32 allows a user to perform standard speaking and listening operations. Furthermore, the present invention can transmit position location information obtained from GPS device 30. In so doing, a user of GPS device 30 can have his or her position location information transmitted by the cellular telephone portion of add-on module 32 to an interested party. The present invention is also well suited to having position location information obtained from GPS device 30 automatically transmitted, via the cellular telephone portion of add-on module 32, to an interested party.

With reference still to FIGS. 4A and 4B, GPS device 30 is modified to include circuitry for controlling standard cellular functions necessary to operate the cellular telephone portion of add-on module 32. That is, functions such as but not limited to dialing, sending, scrolling, ending, etc. are selected and controlled using control buttons, or keys, typically shown as 38 and a display screen 40 present on the GPS device 30. Thus, the present invention provides an independent GPS device 30 which is easily upgraded to include complete cellular telephone functions. A GPS device 30 of the present invention would not intimidate potential consumers by appearing overly complex or bulky. Also, the GPS device of the present invention does not necessarily have the increased cost associated with prior art devices in which the GPS and cellular telephone are permanently combined in a single structure. Rather, in the present invention, purchase costs can be spread between GPS device 30 and add-on module 32.

With reference next to FIG. 5, a simplified schematic diagram illustrating the interconnections between a GPS device 30 and an add-on module 32 is shown. The add-on module 32 includes a cellular telephone circuit 46, a modem circuit 48, and a power/battery source 50. The interconnections between the GPS device 30 and the add-on module 32 are completed in the present embodiment through a control bus 52, an I/O data bus 54, and power bus 56. As shown in FIG. 5, the control connection between the GPS device 30 and the add-on module 32 is accomplished using two UARTs 58 and 60. Control bus 52 connects the keyboard of the GPS device 30 to the cellular telephone portion 46 of add-on module 32. In this manner, the standard functions necessary to operate the cellular telephone portion 46 of the add-on module 32 are controlled through the keys of the GPS device 30. I/O data is transferred between the GPS device 30 and the add-on module 32 via the modem circuit and the I/O data bus 54. Data is transferred in suitable format from either the GPS device 30 to the add-on module 32, or from the add-on module 32 to the GPS device 30. Additionally, the power bus 56 provides power from the power/battery source 50 to the GPS device 30. Power/battery source 50 also provides power to the cellular telephone portion 46 of add-on module 32 as shown in FIG. 5.

FIG. 6 shows a more detailed schematic diagram illustrating the features of the GPS device 30 and more detailed interconnections between the GPS device 30 and the add-on module 32. The GPS device 30 typically includes such

features as a down converter 64, a signal processor 66, ROM 68, RAM 70, a keyboard 72, a display manager 74, a display 76, and a standard microprocessor 78. The GPS device 30 also includes a UART 80 for transferring signals between the microprocessor 78 of the GPS device 30 and a modem circuit 82 of the add-on module 32. Although the present embodiment shows UART 80 separate from microprocessor 78, the present invention is also well suited to directing signals into a microprocessor which has a UART contained therein.

With reference again to FIG. 6, keyboard entries made at the keyboard 72 are used to operate a cellular telephone portion 86 of the add-on module 32. Pressing of the keys on the GPS device 30 simulates the pressing of keys on a cellular telephone. Therefore, commands entered at the GPS device 30 will drive a cellular telephone circuit portion 86 of the add-on module 32.

During typical operation, control signals are transmitted from microprocessor 78 of the GPS device 30 through a control bus 92 to UART 94. Lines 95, 96 between UART 94 and a UART 98 each transmit digital data in only direction. Additionally, control bus 99 directs the data directly into a microprocessor 100 of the cellular telephone portion 86 of add-on module 32. Although the present embodiment shows the UART 94 separate from the microprocessor 78 and the UART 98 separate from the microprocessor 87, the present invention is also well suited to directing signals directly into the microprocessor of the GPS device and then directly into the microprocessor of the cellular telephone portion of the add-on module when both microprocessors have a UART contained therein. It is known in the art that each type of cellular telephone employs a different control protocol. Therefore, although the present invention describes interfacing between a GPS device 30 and an add-on module 32, the actual coding of the commands to be transferred over the control bus is different for each type of cellular telephone.

Referring still to FIG. 6, the present invention teaches removably attaching an add-on module 32 containing a cellular telephone 86 to a GPS device. However, as the technology of cellular telephones advances, the present invention is also well suited to forming cellular telephone portion 86 of the present invention using cellular telephone chip sets within the add-on module on module 32.

FIG. 7 shows a front view of a cellular telephone device 120 which has the battery portion thereof removed.

FIG. 7B shows a side view of the cellular telephone device 120 with a cavity 122 is where batteries or a battery pack would normally reside.

FIG. 8 shows a perspective view of an add-on module 124 attached to the cellular telephone device 120 in accordance with the present invention. The add-on module 124 is inserted into the cavity 122 of the cellular telephone device 120. The cellular telephone device 120 includes a keyboard having keys (typically shown as 123) and a display screen 126. In addition to supplying power to the cellular telephone device 120 via, for example, a battery pack, add-on module 124 also includes a built in GPS receiver device. The cellular telephone device 120 is adapted to receive either a standard battery pack or a combined power source and a GPS receiver as embodied in the add-on module 124. Thus, the add-on module 124 allows a user to obtain standard GPS position location information.

In the present embodiment, the GPS receiver of the add-on module 124 has no controls or display screen. The cellular telephone keys (typically shown as 123) are used as control keys in combination with a display screen 126. All of the GPS information is displayed on the display screen 126 of the cellular telephone device 120. The present invention is also well suited to having such control and display features included in the add-on module 124. In the present invention, the cellular telephone device 120 can transmit position location information obtained from the GPS receiver of the add-on module 124. In so doing, a user of cellular telephone device 120 has his or her position location information transmitted by cellular telephone device 120 to an interested party. The present invention is also well suited to having position location information obtained from the GPS receiver of add-on module 124 automatically transmitted, via the cellular telephone device 120, to an interested party.

The cellular telephone device 120 is modified by the invention to include circuitry for controlling standard GPS functions necessary to operate the GPS receiver portion of the add-on module 124. That is, functions such as, but not limited to, indicating latitude, longitude, altitude, speed, heading etc. are selected and controlled using the control buttons, or keys, present on the cellular telephone device 120. Thus, the present invention provides an independent cellular telephone device 120 which can be easily upgraded to include complete GPS functions. Therefore, cellular telephone device 120 of the present invention does not intimidate potential consumers by appearing overly complex or bulky. Also, the cellular telephone of the present invention does not necessarily have the increased cost associated with prior art devices in which the GPS and cellular telephone are permanently combined in a single structure. Rather, in the present invention, purchase costs can be spread between the cellular telephone device 120 and removably attachable add-on module 124.

FIG. 9 shows a schematic diagram illustrating the interconnections between the cellular telephone device 120 and the add-on module 124 is shown. The cellular telephone device 120 typically includes such features as a display 126, a keyboard 128 with keys 123, a speaker 129, a microphone 130, a microprocessor 132, a transmitter circuit 134, a receiver circuit 136, and a duplexer circuit 138.

The add-on module 124 includes a GPS device 140 including a microprocessor 142, a modem circuit 144, and a power/battery source 146. The interconnections between the cellular telephone device 120 and the add-on module 124 are completed in the present embodiment through a control bus 150, 152, I/O data lines 154, 156, and a power bus 158. Power bus 158 provides power from the power/battery source 146 to GPS device 140. These power/battery source 146 also provides power to the cellular telephone portion. The control connections between the cellular telephone device 120 and the add-on module 124 are accomplished using two UARTs 160, 162, control buses 150, 152 connect the keyboard 128 of the cellular telephone device 120 through the microprocessor 132 to the microprocessor 142 of the GPS device 140. In this manner, the standard functions necessary to operate the GPS device 140 of the add-on module 124 are controlled through the keyboard 128 of the cellular telephone device 120. I/O data is transferred between the cellular telephone device 120 and the add-on module 124 via the modem circuit 144 and the I/O data lines 154, 156. In so doing, data can be transferred in suitable format from either the cellular telephone device 120 to the add-on module 124, or from the add-on module 124 to the cellular telephone device 120. The add-on module 124 also includes a UART 166 disposed between the microprocessor 142 of the GPS device 140 and the modem 144 of add-on module 124. Although the present embodiment shows the

UART **166** separate from the microprocessor **142**, the present invention is also well suited to directing signals into a microprocessor which has a UART contained therein.

With reference still to FIG. **9**, keyboard entries made at the keyboard **128** are used to operate the GPS portion **140** of the add-on module **124**. That is, the pressing of keys on the cellular telephone device **120** simulates the pressing of keys on a GPS device. Therefore, commands entered at cellular telephone device **120** will drive the GPS device portion **140** of the add-on module **124**. During typical operation, control signals are transmitted from the microprocessor **132** of the cellular telephone device **120** through the control bus **150** to the UART **160**. Lines **168** and **170** each transmit digital data in only one direction. Additionally, control bus **152** directs the data directly into the microprocessor **142** of the GPS device portion **140** of the add-on module **124**. Although the present embodiment shows the UART **160** separate from the microprocessor **132** and the UART **162** separate from the microprocessor **142**, the present invention is also well suited to directing signals directly into the microprocessor of the cellular telephone device and directly into the microprocessor of the GPS device portion of the add-on module when both microprocessors have a UART contained therein. Additionally, it is known in the art that each type of cellular telephone employs a different control protocol. Therefore, although the present invention sets forth interfacing between a cellular telephone device **120** and an add-on module **124**, the actual coding of the commands to be transferred over the control buses **150**, **152** is different for each type of cellular telephone.

Referring again to FIG. **9** in the present embodiment, interconnections between lines **154**, **156** of the add-on module **124** and the receiver **136** and the transmitter **134** are accomplished using switches **172**, **174**. That is, if data from GPS device **140** is to be transmitted to cellular telephone device **120**, each of the switches **172**, **174** contact point "D". However, when the cellular telephone device **120** is operating in normal voice mode, the switches **172**, **174** contact point "V". Although the present embodiment employs switches **172**, **174**, the present invention is also well suited to using other connection methods.

The foregoing descriptions of specific embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents.

I claim:

1. A hand-held communication device providing a position-locating function and a cellular telephone function, comprising:

a hand-held core module having means for entering information including control information, means for displaying information, and first means for providing a first function;

a removable add-on module containing a battery and removably fixed to said core module for providing power to said first means, said removable add-on module also having second means integral therewith for providing a second function;

wherein said first function and said second function includes a GES function and a cell phone function; and

means for removably coupling power from the battery as well as control and information signals between said core module and said removable add-on module, wherein said core module includes means for controlling the second function provided by the removable add-on module;

whereby the hand-held core module and the removable add-on module are fixed together to provide an integral hand-held communication device containing a battery and having a position-locating function and a cellular telephone function.

2. The communication device of claim **1** wherein the first means includes the GPS means and the second means includes the cell-phone means.

3. The communication device of claim **1** wherein the first means includes the cell-phone means and the second means includes the GPS means.

4. The communication device of claim **1** wherein means for entering information includes a keypad on said core module.

5. The communication device of claim **1** wherein the means for displaying information includes a display screen on said core module.

6. The communication device of claim **1** wherein the means for providing cell-phone functions includes a microphone and speaker.

7. A hand-held device having position-locating and cellular telephone capabilities comprising:

a hand-held position-locating unit,

a removable battery power module, removably fixed to said hand-held position-locating unit to form an integral hand-held device having position-locating and cellular telephone capabilities, wherein said battery power module includes a battery for providing power to said position-locating unit, wherein said battery power module includes a cellular telephone circuit integral therewith, and wherein the hand-held position-locating unit and the removable battery power module together form an integral hand-held unit; and

means for removably coupling power as well as control and information signals between said position-locating unit and said removable battery power module.

8. The device of claim **7** including control means, located on said position-locating portion of said hand-held position-locating unit and coupled to said cellular telephone circuit integral with said battery power module, for controlling said cellular telephone circuit.

9. The device of claim **7** wherein said cellular telephone circuit includes means for transmitting position location information obtained by said position-locating unit.

10. The device of claim **7** wherein said position-locating unit includes a GPS unit.

11. A hand-held device having cellular telephone and position-locating capabilities comprising:

a hand-held cellular telephone unit;

a removable battery power module removably fixed to said cellular telephone unit to form an integral hand-held unit, wherein said battery power module includes means for providing power to said hand-held cellular telephone unit and wherein said battery power module includes a position-locating device integral therewith; and

means for removably coupling power as well as control and information signals between said cellular telephone unit and said battery power module.

12. The device of claim 11 including control means, located on said cellular telephone unit and coupled to said position-locating device integral with said battery power module, for controlling said position locating device.

13. The device of claim 12 wherein said cellular telephone portion includes means for transmitting position location information obtained by said position-locating device integral with said battery power module.

14. The device of claim 11 wherein the cellular telephone unit includes a microphone and speaker.

* * * * *